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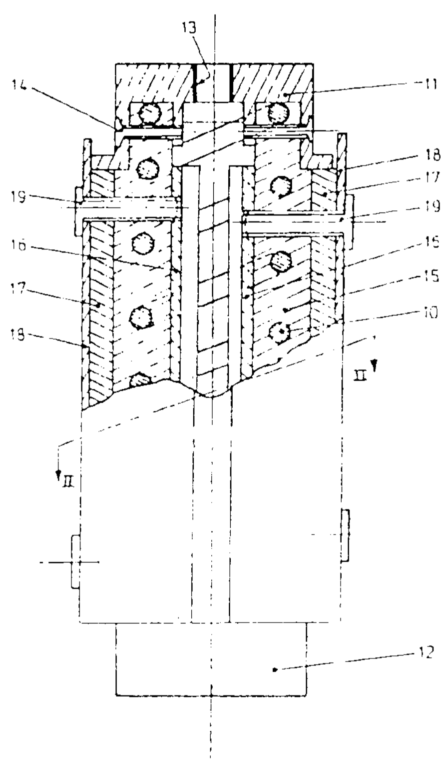
(58) Field of search
F2S

(54) A load-bearing element

(57) A load-bearing element comprising one or more helical springs (10) of steel or other metal embedded in an annular damping member (15) of a polymeric material. In one embodiment, part-cylindrical steel supports (16, 18) clamped together adjustably by screws (19) serve to compress damping member (15) and an outer damping member (17) thus to adjust the axial and lateral stiffness of the spring and damping members, and in turn to control transmission of vibration throughout the length of the element.

FIGURE 1



GB 2 143 299 A

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1982.

FIGURE 1

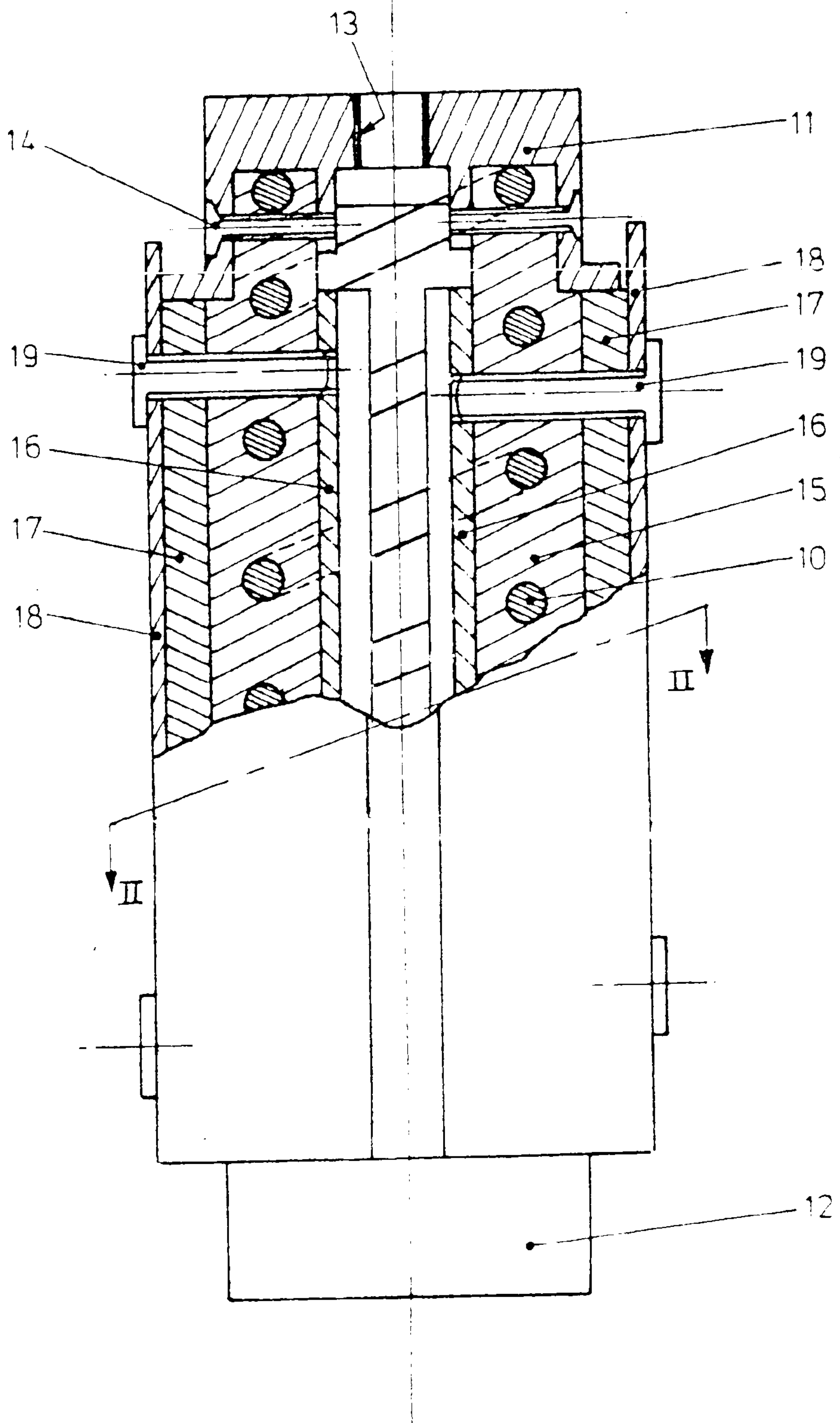
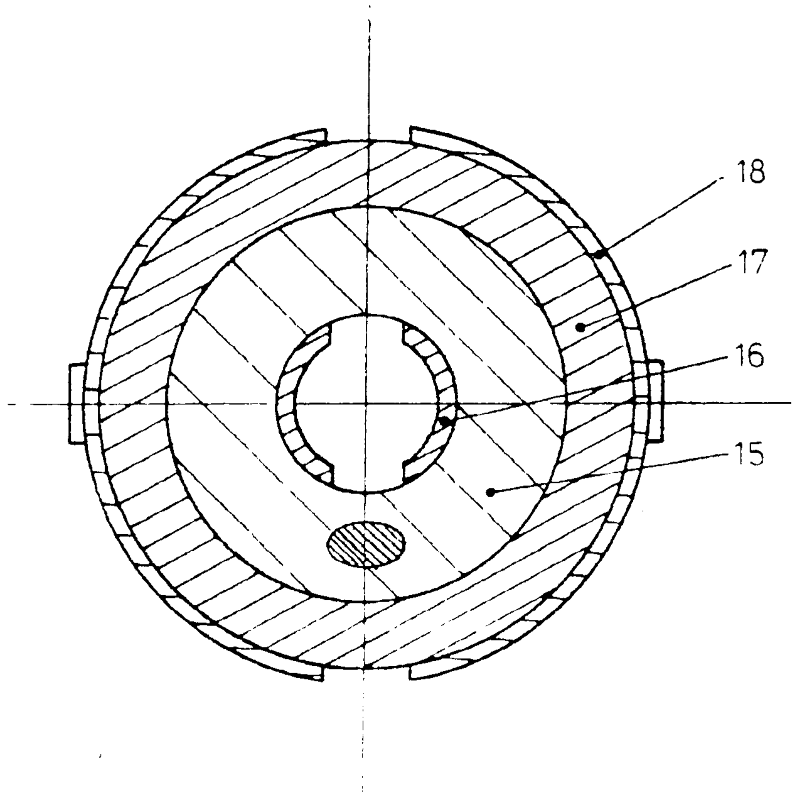


FIGURE 2



SPECIFICATION

A load-bearing element

This invention concerns a compound load-bearing element including a helical metal spring and one or more other resilient members acting in parallel, and can support loads either in compression or in extension.

The inherently poor damping properties of a metal coil spring when used to support a load do not prevent high and low frequency vibration being transmitted to or from the load. Severe vibration can cause wave effects (sometimes known as spring surge) in the spring owing to the tendency for the individual coils or rings of the spring to vibrate relative to each other. Therefore not only does the spring transmit substantially all of the vibration imposed upon it but in certain circumstances can even amplify the effect.

In general, vibration isolators require significant damping to minimise both low and high frequency effects. Conventionally this has been partially achieved using a resilient mounting in shear, or alternatively a damper unit containing oil or pressurised gas. In the case of resilient mounts, these are subject to rapid wear when loaded in shear, or to age-hardening when in compression giving rise to a gradual collapse of the support. In addition, there is the problem of relaxation owing to a gradual change in state of the resilient material preventing it from maintaining its true resilience. Therefore, it is evident that, whilst the resilient mount provides good damping its load-bearing properties are poor when compared with a metal spring. Further, variable damping properties are not possible since the shear mode of operation restricts operation to a single material.

Oil and gas damper units appear to be effective in isolating low frequency vibration but tend to be ineffective at higher frequencies, and they are inherently expensive devices, particularly where large loads are to be supported.

An object of the present invention is to provide a low cost load-bearing element which affords ample support whilst also providing good variable damping properties at both low and high frequencies.

According to the present invention there is provided a load-bearing element comprising a helical spring adapted to support a load either in compression or in extension, characterised in that, under load, the spring is at least partially embedded in a resilient material to control transmission of vibration throughout the length of the spring.

A simple embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:-

Figure 1 illustrates, partially in vertical section, a coil spring adapted to support a load in compression; and

Figure 2 is a section taken on line II-II of Figure 1.

Referring now to the drawings, Figure 1 illustrates a steel or other metal coil spring 10 disposed between a pair of end caps 11 and 12 which are threaded for mounting purposes at 13 and locate the metal coil spring by means of fasteners 14. Attached by moulding to the spring 10 is an annular damping member 15 of a resilient material, preferably a polymeric material which is inert in the presence of oil or other substance present in the environment in which the element is to be used. For certain applications, it is necessary for the resilient material to be unaffected by high temperatures so that its deformation characteristics are unchanged.

Within the annular damping member 15 are located part-cyclindrical steel supports 16 (see Figure 2), which may be bonded thereto.

Attached to the outside of the annular damping member 15 is an additional annular damping member 17. Outer part-cylindrical steel supports 18 and the inner steel supports 16 are drawn together by screws 19 to clamp or compress the damping members 15 and 17 together.

In use axial compression of the element is permitted by the clearance between the ends of the supports 16 and the respective end cap 11, 12.

The inner and outer damping members 15 and 17 can be of different resilient materials chosen such that the optimum damping configuration for a given situation is obtained. Further, depending upon the pressure applied by the fasteners 19, the axial stiffness of the assembly can be varied. In certain cases it may not be necessary for the additional damping elements 17, and the supports 16 and 18 to be present. In these cases, the system would utilise solely the damping properties of the damping member 15.

It will be appreciated that a load-bearing element made in accordance with the invention combines the load supporting properties and durability of a metal coil spring whilst the transmission of low and high frequency vibration is minimised or controlled by embedding the spring in parallel resilient materials. Such a device is simple and inexpensive in manufacture, and the thickness and disposition of the damping members relative to the helix of the spring can be selected according to the application. Different polymers, or even rubbers, can be adopted according to the intended use, i.e., the damping properties of different polymers can be incorporated into one active device.

This novel load-bearing element can be used to provide support in any system in which high axial and lateral stiffness is required with effective damping and minimum loss of support with age. If completely embedded, the coil spring is protected by the resilient member from corrosion or other ambient effects.

Some examples of the application of this device are engine-supporting mounts, vehicle suspension springs and shock absorbers, industrial vibration and shock isolators and cam-follower mechanisms preventing the phenomenon known as "follower bounce" normally created by spring surge which causes rapid failure of valve springs used in engines.

It is not intended to limit the invention to the above examples only, many variations, such as might readily occur to one skilled in the art, being possible without departing from the scope of the invention.

CLAIMS

1. A load-bearing element comprising a helical spring, and characterised in that the spring is at least partially embedded in a resilient material thus to control transmission of vibration throughout the length of the spring.

2. A load bearing element according to Claim 1, wherein said helical spring is embedded within an annular damping member of said resilient material disposed between a pair of end caps one at each end of said helical spring.

3. A load-bearing element according to Claim 2, including a further annular damping member of greater diameter mounted co-axially around said first mentioned damping member.

4. A load-bearing element according to any preceding claim, including means for adjusting the axial and/or lateral stiffness of said resilient material.

5. A load-bearing element according to Claim 5, wherein said adjustment means comprises inner and outer part-cylindrical rigid supports, and means for adjustably clamping said supports thus to compress said resilient material.

6 A load-bearing element according to any preceding claim, wherein said resilient material is a polymeric material.

7 A load-bearing element according to Claim 3, wherein said annular damping members are of different polymeric materials having different physical characteristics.

8. A load-bearing element according to any preceding claim, wherein said resilient material is selected to be unaffected by substances or conditions present in the environment in which the element is to be used.

9. A load-bearing element substantially as hereinbefore described, with reference to and as illustrated in the accompanying drawings.

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